Model 9102 HDRC

Handheld Low-Temp Dry-well

User Manual

Hart Scientific

CE

Rev. 8A1401

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WARNING

To ensure the safety of operating personnel, and to avoid damage to this equipment:

DO NOT operate this unit without a properly grounded, properly polarized power cord.
DO NOT connect this unit to a non-grounded, non-polarized outlet.

DO USE a ground fault interrupt device.

WARNING

To ensure the safety of personnel, and to avoid damage to equipment:

DO NOT use this unit for any application other than calibration work.
DO NOT use this unit in environments other than those listed in the user's manual.

Continous use of this equipment at high temperatures for extended periods of time requires caution.

Completely **unattended high temperature operation is not recommended** for safety reasons.

Components and heater lifetimes can be shortened by continuous high temperature operation.

Follow all safety guidelines listed in the user's manual.

WARNING

CALIBRATION EQUIPMENT SHOULD ONLY BE USED BY TRAINED PERSONNEL.

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1 Introduction

Hart Scientific's Model 9102 HDRC Low-Temp Dry-well Calibrator is a small, portable instrument designed for quick on-site checks and calibration of thermocouple and RTD temperature probes. It features an aluminum temperature block with two calibration insert sleeves. Each well can accept temperature sensors up to 1/2" in diameter and uses insert blocks that resize the well. See page 11 for insert sizes.

The instrument is controlled by a microprocessor based digital PID temperature controller and uses a precision platinum RTD as a sensor with thermoelectric modules to control the well temperature. The controller display will show the well temperature and also the set-point temperature. The temperature may be set to any temperature within the range of the instrument in 0.1 degree increments by using the three buttons on the control panel.

The 9102 dry-well calibrator was designed for portability, speed, and ease of operation. It's use will provide a means of quick, accurate calibration and comparisons of temperature sensors and other devices.

2 Specifications and Environmental Conditions

2.1 Specifications

Operating Range	–10°C to 122°C (14°F to 251°F)
Accuracy	–10 to 100°C: ±0.5°C 100 to 122°C: ±1°C
Stability	±0.2°C, typical
Heating Times	25 to 100°C: 10 min. –10 to 100°C: 25 min. 100 to 122°C: 30 min.
Stabilization	5–10 min.
Cooling Times	25 to –10°C: 10 min. 122 to –10°C: 40 min.
Wells	Two 1/2" wells (0.515") with removable inserts; 1/4- and 3/16-inch inserts are supplied. Additional inserts are sold separately. See below for sizes.
Depth	4 inches (101.6mm)
Well to Well Uniformity	0.2°C with sensors of similar size at the same depth in the well.
Power	115 VAC (±10%), 50/60 Hz 0.5 Amps max. or 12 VDC 3 Amps.
Size	3.25 x 6.0 x 6.75 inches (83mm x 152mm x 171mm)
Weight	4 lbs. (1.8 Kg)

2.2 Environmental Conditions

Although the instrument has been designed for optimum durability and trouble-free operation, it must be handled with care. The instrument should not be operated in an excessively dusty or dirty environment. Maintenance and cleaning recommendations can be found in the Maintenance Section of this manual.

The instrument operates safely under the following conditions:

- temperature range: 5–40°C (41–104°F)
- ambient relative humidity: 15–50%
- pressure: 75kPa–106kPa
- mains voltage within ±10% of nominal
- vibrations in the calibration environment should be minimized
- altitude does not effect the performance or safety of the unit

2.3 Warranty

Hart Scientific, Inc. (Hart) warrants this product to be free from defects in material and workmanship under normal use and service for a period as stated in our current product catalog from the date of shipment. This warranty extends only to the original purchaser and shall not apply to any product which, in Hart's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or handling.

Software is warranted to operate in accordance with its programmed instructions on appropriate Hart products. It is not warranted to be error free.

Hart's obligation under this warranty is limited to repair or replacement of a product which is returned to Hart within the warranty period and is determined, upon examination by Hart, to be defective. If Hart determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions or operation or handling, Hart will repair the product and bill the purchaser for the reasonable cost of repair.

To exercise this warranty, the purchaser must forward the product after calling or writing Hart for authorization. Hart assumes NO risk for in-transit damage.

For service or assistance, please contact the manufacturer.

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THE FOREGOING WARRANTY IS PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR MECHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE. HART SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

3 Safety Guidelines

- Operate the instrument in room temperatures between 5–40°C (41–104°F). Allow sufficient air circulation by leaving at least 6 inches of space between the instrument and nearby objects. Overhead clearance needs to allow for safe and easy insertion and removal of probes for calibration.
- The dry-well is a precision instrument. Although it has been designed for optimum durability and trouble free operation, it must be handled with care. Always carry the unit in an upright position to prevent the probe sleeves from dropping out. The convenient fold-up handle allows one hand carrying. The instrument should not be operated in excessively wet, oily, dusty, or dirty environments. It is important to keep the well of the instrument clean and clear of any foreign matter. **DO NOT** operate near flammable materials.
- **DO NOT** use fluids to clean out the well.
- The instrument can generate extreme temperatures. Precautions must be taken to prevent personal injury or damage to objects. Probes may be extremely hot or cold when removed from the instrument. Cautiously handle probes to prevent personal injury. Always use the special sleeve tongs that are supplied with the calibrator to remove the sleeve. Carefully place probes on a heat/cold resistant surface or rack until they are at room temperature. Never place any objects other than the special probe sleeves supplies with the calibrator into the well.
- Use only a grounded AC mains supply of the appropriate voltage to power the instrument. The dry-well requires 0.5 amps for AC (3.3 amps for DC), 115 VAC (±10%) or 230 VAC (±10%), 50/60 Hz.
- Before initial use, after transport, and anytime the dry-well has not been energized for more than 10 days, the instrument needs to be energized for a “dry-out” period of 1-2 hours before it can be assumed to meet all of the safety requirements of the IEC 1010-1.
- The instrument is equipped with internal fuses. If a fuse blows, contact Hart Scientific Customer Service.
- If a mains supply power fluctuation occurs, immediately turn off the instrument. Power bumps from brown-outs and black-outs could damage the instrument. Wait until the power has stabilized before re-energizing the instrument.

4 Quick Start

4.1 Unpacking

Remove the instrument from all packaging materials before operation. In the original package you should have received the following list of materials:

- 9102 HDRC
- Power cord
- User Manual
- Report of Calibration
- 3102-3 Insert, 3/16"
- 3102-4 Insert, 1/4"
- Insert removing tool

If you have not received all of these items or received damaged materials please call Hart Scientific Customer Service.

4.2 Set-up

Place the calibrator on a flat surface with at least 6 inches of free space in front of and behind the instrument. The prop may be swung down to raise the front of the instrument from a horizontal position. Plug the power cord into an AC grounded outlet or plug in 12 VDC into rear jack.

By plugging in the 12 VDC jack the unit is automatically turned on.

The well must be clear of any foreign objects before probes are inserted. Turn on the power to the calibrator by toggling the switch at the rear of the instrument to the on position. The controller display should illuminate and after a few second the fan should begin blowing air through the instrument. If the unit fails to operate check the power connection. When the instrument is first powered on all of the LED segments will temporarily illuminate as the controller performs a brief self-test and set-up. The display will then begin to show the actual block temperature and the controller will begin operating to bring the temperature of the well to the set-point temperature.

4.3 Power

Plug the dry-well power cord into a mains outlet of the proper voltage, frequency, and current capability. Typically this will be 115 VAC (±10%), 50/60 Hz or 230 VAC (±10%), 50/60 Hz. Turn the instrument on using the switch on the rear panel. The dry-well will turn on and begin to heat to the previously programmed temperature set-point. The front panel LED display will indicate the actual temperature.

5 Parts and Controls

The user should become familiar with the dry-well calibrator and its parts: (See Figures 1 and 2).

5.1 Rear Panel

Power Cord - The power cord (Figure 1) attaches to the back side of the 9102 and is removable. It plugs into a standard 115 VAC (optional 230 VAC) grounded socket.

DC Power Jack - The calibrator can be used from a DC power source. The DC input jack requires 12 V and 3.3 amps. See the inset in Figure 1 for pinout.

Power Switch - The power switch is located on the back panel of the instrument. The switch is either on or off. The on position is for normal operation. The off position disconnects power to the entire unit.

Fan - A fan inside the calibrator runs when the unit is being operated below 50°C. This provides cooling to the instrument. Above 50°C the fan turns off. **DO NOT** place an external fan in front of the instrument. Allow 6 inches of open space in front and behind the instrument to allow adequate ventilation.

Prop - The prop is located on the bottom side of the 9102 and lays flat against the bottom of the instrument when not in use. It can be swung down into a standing position when using the instrument at an inclined position.

Figure 1 *Rear Panel*

The prop was not designed to be used as a handle for carrying the instrument. To avoid damage, it should not be forced beyond the inclined position of the instrument.

5.2 Front Panel

Strap - A strap is provided to aid the user in carrying the 9102 in one hand. Slide your hand into position and secure using the velcro for a tight fit. Be careful when carrying the 9102 while using the strap; inserts can fall out of the wells when tipped forward. Inspect the strap periodically for wear.

Well Block - Located in the middle of the front panel (while facing the front of the 9102) are the well openings where probes may be inserted into the well blocks (Figure 2). The block is designed to accept temperature sensors up to 1/2" in diameter. Using optional inserts, the wells can be made to accept probes of smaller than 1/2" diameter. For best results it is recommended that probes fit snugly into the wells.

Controller Display - The numeric LED display shows the process temperature or the actual temperature of the well from –10.0 to 122.0°C. (–14.0 to 251.0°F.) The display shows the set-point temperature when the ✶ button is pressed. Located in the upper left of the temperature display is the main set-point (SP1) LED. This is the cycle indicator and shows the on/off state of the thermoelectric modules. The bottom right side LCD (SP2) flashes when the fan is off.

Controller Buttons - The three buttons on the controller allow for adjustment of the set-point temperature. When pressed, the button marked ✶ toggles the display from the actual block temperature to the set-point temperature with the

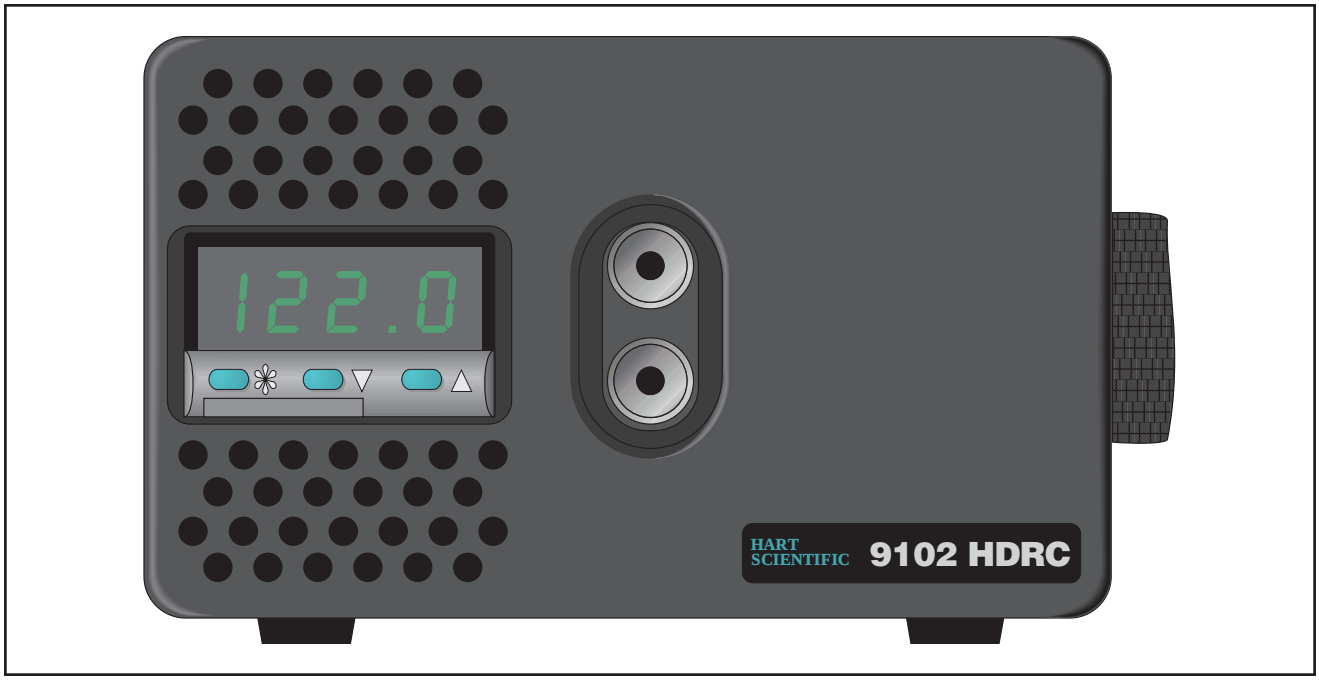

Figure 2 *Front Panel*

units of measure being used (°C or °F). While holding the ✶ button, the set-point temperature can be changed by pressing and holding in either the button marked ▲ or ▼ until the desired set-point is reached. The longer the keys are held down, the faster the set-point will change. When the desired set-point temperature is reached, releasing ✶ button immediately changes the display back to the actual block temperature and the controller begins to heat or cool to the new set-point temperature.

5.3 Accessories

Model	Description
3102-0	Blank Insert
3102-1	1/16 Insert
3102-2	1/8 Insert
3102-8	5/32 Insert
3102-3	3/16 Insert
3102-4	1/4 Insert
3102-5	5/16 Insert
3102-6	3/8 Insert
3102-7	7/16 Insert
9308	Rugged Carrying Case

Call the factory at 800-438-4278 for current pricing.

6 General Operation

6.1 Set-up

Place the calibrator on a flat surface with at least 6 inches of free space in front of and behind the instrument. The prop may be swung down to raise the front of the instrument from a horizontal position. Plug the power cord into an AC grounded outlet or plug in 12 VDC into rear jack.

By plugging in the 12 VDC jack the unit is automatically turned on.

The well must be clear of any foreign objects before probes are inserted. Turn on the power to the calibrator by toggling the switch at the rear of the instrument to the on position. The controller display should illuminate and after a few second the fan should begin blowing air through the instrument. If the unit fails to operate check the power connection. When the calibrator is first powered on all of the LED segments will temporarily illuminate as the controller performs a brief self-test and set-up. The display will then begin to show the actual block temperature and the controller will begin operating to bring the temperature of the well to the set-point temperature.

6.2 Setting the Temperature

The dry-well calibrator may be set to any temperature between –10.0 and 122.0°C in 0.1°C increments. To set the temperature, simply press and hold the ✶ key and the appropriate ▲ or ▼ button until the desired temperature is attained. Pressing the ✶ button changes the numeric display to show the set-point temperature and activates the ▲ and ▼ keys. Note that the longer the ▲ or ▼ keys are held down, the faster the set-point will change. When the desired set-point temperature is reached, release the ▲ or ▼ and the ✶ buttons. The panel will resume display of the actual block temperature.

If the set-point temperature is changed the controller will cause the unit to heat or cool to the desired set-point temperature. The cycle indicator LED will pulse on and off indicating the duty cycle of the thermoelectric modules. The display will indicate the actual block temperature which continuously changes until it reaches the set-point temperature. A small overshoot in the block temperature is typical as it stabilizes to the set-point temperature. Five to ten minutes is normally required for the block to reach the set-point temperature if the set-point is adjusted to a higher value. It may take a little longer if the set-point is adjusted to the outer temperature limits

7 Controller Operation

The controller is fully programmable. Each of the parameters such as proportional band, integration time, display units, and calibration offset can be viewed and altered. The controller has been configured at the factory for optimum accuracy, stability, and response time. It is recommended that these parameters not be changed although the user is free to do so if desired. The following section explains how the controller is programmed and particularly how to switch the parameter units from the factory settings.

7.1 Programming

The controller is shipped from the factory with a software lock on all programmable parameters. This prevents accidental accessing and changing of the pre-set parameters. The 9102 parameters can be browsed and read without unlocking the software lock mentioned above. (See Figure 3.)

Programming the controller and accessing the parameter settings is done using the three controller keys just below the display. The program menu is entered and exited by pressing the ▲ and ▼ buttons at the same time for three seconds. After three seconds the controller will enter level 1 of its menu. The display will toggle between tUnE and oFF.

From this point in the control menu, the ▲ and ▼ buttons can be used to step up or down through the parameters of level 1. To access another level of the controller, press the ▼ button to step through the controller parameters to the bottom of level 1 until the display toggles between LEUL and 1. From this point the other 2 levels are accessed by pressing and holding in the ✶ button and pressing the ▲ button to step to levels 2 or 3. Each of the 3 levels can be stepped through in the same way using the ▲ or ▼ button.

7.2 Locking/Unlocking the Controller

In order to change any parameter, the controller will have to be unlocked. The lock/unlock parameter is accessed by going into level 3 as explained above. Once inside level 3 (see Figure 3), step up until the UEr and 2 is toggling on the display. Now press and hold the ▲ and ▼ buttons simultaneously for 10 seconds. The LoCK and ALL should now be alternating on the display (see Figure 4). Press the ✶ button and step down using the ▼ button until nonE appears in the display. Holding down the ▲ and ▼ buttons for 3 seconds from this point will unlock all controller parameters and settings and return the controller display to show the block temperature.

7.3 Switching display units

The calibrator is set at the factory to display in °C or °F. At some point the user may want to change units from °C to °F or from °F to °C. The unit change is a simple one that can be used as an example of changing any of the variables or parameters within the program menu. After unlocking the controller as de-

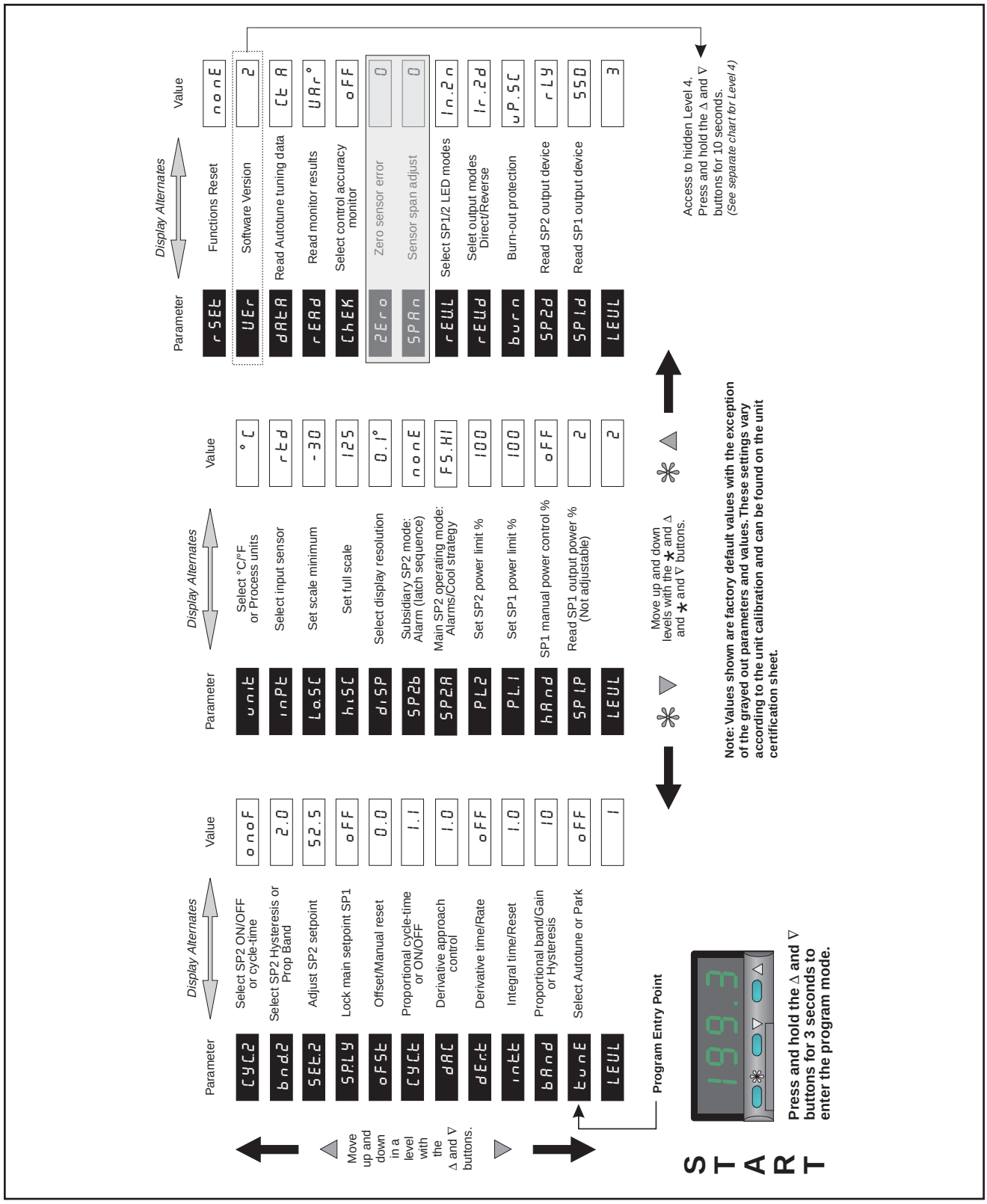
Parameter
Value
Display Alternates
Select SP2 ON/OFF or cycle-time
Select SP2 Hysteresis or Prop Band
Adjust SP2 setpoint
Lock main setpoint SP1
Offset/Manual reset
Proportional cycle-time or ON/OFF
Derivative approach control
Derivative time/Rate
Integral time/Reset
Proportional band/Gain or Hysteresis
Select Autotune or Park
Move up and down in a level with the Δ and ∇ buttons.
Select °C/°F or Process units
Select input sensor
Set scale minimum
Set full scale
Select display resolution
Subsidiary SP2 mode: Alarm (latch sequence)
Main SP2 operating mode: Alarms/Cool strategy
Set SP2 power limit %
Set SP1 power limit %
SP1 manual power control %
Read SP1 output power % (Not adjustable)
Move up and down levels with the ✱ and Δ and ✱ and ∇ buttons.
Functions Reset
Software Version
Read Autotune tuning data
Read monitor results
Select control accuracy monitor
Zero sensor error
Sensor span adjust
Select SP1/2 LED modes
Selet output modes Direct/Reverse
Burn-out protection
Read SP2 output device
Read SP1 output device
Access to hidden Level 4. Press and hold the Δ and ∇ buttons for 10 seconds. (See separate chart for Level 4)
Note: Values shown are factory default values with the exception of the grayed out parameters and values. These settings vary according to the unit calibration and can be found on the unit certification sheet.
Program Entry Point
Press and hold the Δ and ∇ buttons for 3 seconds to enter the program mode.
START

Figure 3 *Controller Programming Chart*

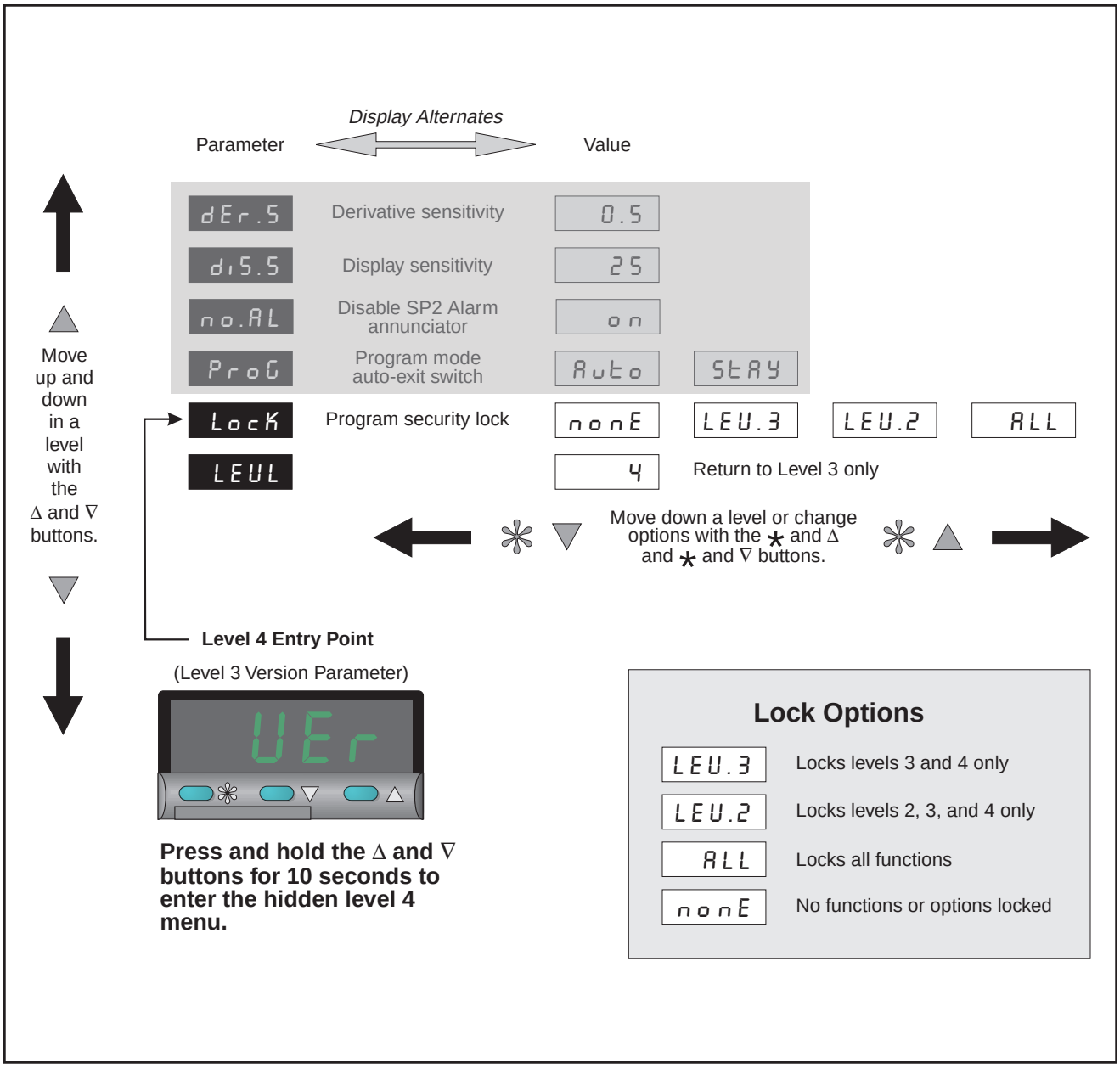

Figure 4 *Controller Level 4 (Parameter Lock Options) Programming Chart*

scribed above, press the ▲ and ▼ buttons for 3 seconds. This accesses level 1 of the menu.

Once inside level 1, the other levels of the menu may be accessed. After looking at the menu chart (Figure 3), the user can see that the unit parameter is changed within level 2. Press the ▼ button to get to the bottom of level 1 where the LEUL and 1 are shown alternating in the display. Press and hold the ✶ button and press the ▲ button until the 2 shows on the display. Now inside level 2, use the ▲ and ▼ buttons to find the unit parameter. Notice how the display flashes between unit and °C. Press and hold the ✶ button and press the ▼ button until °F shows on the display. After the buttons are released, the

display should be flashing unit and °F instead of unit and °C. The change has been made.

To return to the temperature display either press and hold the ▲ and ▼ buttons for 3 seconds or wait approximately 1 minute and the controller will automatically return. This is how all of the adjustable parameters for the controller work on the 9102 HDRC Calibrator. The controller may be locked again after changing parameters to avoid accidentally changing one of them. Follow the instructions above and replace the nOnE at the LoCK menu with ALL and then exit out of the program menu as explained.

8 Test Probe Calibration

For optimum accuracy and stability, allow the instrument to warm up for 10 minutes after power-up and then allow adequate stabilization time after reaching the set-point temperature. After completing calibration, allow the block to cool before switching the power off.

8.1 Calibration Methods

8.1.1 Direct Calibration

Direct calibration involves testing a probe directly against the dry-well's temperature display. The advantage of this method is that it is quick and easy.

Insert the probe to be calibrated into the well of the dry-well instrument. The probe should fit snugly into the instrument probe sleeve yet should not be so tight that it cannot be easily removed. Avoid any dirt or grit that may cause the probe to jam into the sleeve. Best results are obtained with the probe inserted to the full depth of the well. Once the probe is inserted into the well, allow adequate stabilization time to allow the test probe temperature to settle as described. Once the probe has settled to the temperature of the well, it may be compared to the instrument display temperature. The display temperature should be stable to within 0.2°C for best results.

Never introduce any foreign material into the probe hole of the insert. Fluids, etc., can leak into the instrument causing damage to the instrument or binding and damage to your probe.

8.1.2 Comparison Calibration

Comparison calibration involves testing a probe against a similar reference probe. The advantage to this method is that better accuracy can be achieved since errors due to dry-well inaccuracy, stem effect, and drift can be reduced.

After inserting the probes to be calibrated, allow sufficient time for the probes to settle and the temperature of the instrument to stabilize.

It is best if both the reference probe and the probe under test are the same size and construction. Using probes with different lengths, diameters and materials will have different stem effects causing an unknown temperature difference. All dry-wells have horizontal and vertical gradients that change with temperature . This is an unknown variable which can be factored out if probes are the same type, length, diameter, and material. Probes should be inserted to the same depth in the well.

The following procedure can be used to calibrate a probe against a reference while eliminating error due to temperature gradients between wells.

- Place the reference probe in one well, the reference probe.
- Place the probe to be calibrated, the unit under test (UUT), in another well.
- With the reference inserted into one well and the probe under test inserted into a second well, make measurements of each.

- Swap the locations of the reference probe and probe under test. Allow plenty of time for thermal settling.
- Make another set of measurements of the reference probe and the probe under test.
- Average the two measurements of the reference probe. Average the two measurements of the probe under test. Averaging the two measurements in this way eliminates error due to temperature gradients between the two wells.
- You may now compare the averaged measurement of the probe under test with the averaged measurement of the reference probe.
- For best results repeat the test several times at the same temperature and at different temperatures.

This method can be used with different types of probes but the user must determine the uncertainty of the measurement.

8.2 Dry-Well Characteristics

Understanding the thermal characteristics of the dry-well instrument can help you achieve the best accuracy and efficiency possible.

8.2.1 Vertical Gradient

There is a temperature gradient vertically in the test well. The heater has been applied to the block in such a way as to compensate for nominal heat losses out of the top of the dry-well and minimize vertical temperature gradients. However, actual heat losses will vary depending on the number and types of probes inserted into the instrument and the block temperature. For best results, insert probes the full depth of well.

8.2.2 Stabilization and Accuracy

The stabilization time of the dry-well instrument will depend on the conditions and temperatures involved. Typically, the dry-well will be stable to 0.2°C within 5 minutes of reaching the set-point temperature as indicated by the display. Ultimate stability will be achieved 10 to 20 minutes after reaching the set temperature.

Inserting a cold probe into a well will require another period of stabilization depending on the magnitude of the disturbance and the required accuracy. For example, inserting a ¼ inch diameter probe at room temperature into a sleeve at 300°C will take approximately 5 minutes to be within 0.1°C of its set-point and will take 10 minutes to achieve maximum stability.

Decreasing the time required for the calibration process can be accomplished by knowing how soon to make the measurement. Typical measurements should be made at the desired temperatures with the desired test probes to establish these times.

9 Calibration Procedure

9.1 Pre-Calibration

Make sure all parameters in the controller are set according to the parameter table provided in the operation manual.

a) Turn the unit on.

b) Set all parameters to the values shown in the chart.

9.2 Calibration

Accuracy Specification: ± 0.5°C for -10 to 100°C ±1.0°C for 100 to 122°C

9.2.1 Span Adjust

1. Record the current span value ($span_{cur}$)
2. Set the controller to 0°C (S_{low}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.
3. Record the actual temperature of the dry-well at 0°C. (T_{low})
4. Set the controller to 100°C (S_{high}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.
5. Record the actual temperature of the dry-well at 100°C. (T_{high})
6. The new span value is calculated by the following formula:

$$span = 100\left(\frac{error_{high} - error_{low}}{T_{high} - T_{low}}\right) + span_{cur}$$

where

$$error_{high} \text{ is } T_{high} - S_{high}$$

and

$$error_{low} \text{ is } T_{low} - S_{low}\ .$$

7. Record and set the new span parameter.

9.2.2 Zero Adjust

Note: New temperature measurements must be taken. You cannot use the values from span adjust.

1. Record the current zero value ($zero_{cur}$)
2. Set the controller to 0°C (S_{low}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.

3. Record the actual temperature of the dry-well at 0°C. (T_{low})

4. Set the controller to 100°C (S_{high}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.

5. Record the actual temperature of the dry-well at 100°C. (T_{high})

6. Calculate the “zero” parameter by averaging the error values:

$$zero = \left(\frac{error_{low} + error_{high}}{2} \right) + zero_{cur}$$

where

$$error_{high} \text{ is } T_{high} - S_{high}$$

and

$$error_{low} \text{ is } T_{low} - S_{low}.$$

7. Record and set the zero parameter.

9.2.3 Accuracy Check

Set the controller to –10°C. Allow about 15 minutes for stabilization after reaching the set-point temperature. Record the actual temperature of the dry-well. Repeat for set-points of 25°C, 50°C, 55°C, 100°C and 122°C.

If any of the measured temperatures are not within specification, repeat the Span Adjust and the Zero Adjust section of the procedure as needed.

10 Maintenance

- The calibration instrument has been designed with the utmost care. Ease of operation and simplicity of maintenance have been a central theme in the product development. Therefore, with proper care the instrument should require very little maintenance. Avoid operating the instrument in an oily, wet, dirty, or dusty environment.
- If the outside of the instrument becomes soiled, it may be wiped clean with a damp cloth and mild detergent. **DO NOT** use harsh chemicals on the surface which may damage the paint.
- Keep the well of the instrument clean and clear of any foreign matter. **DO NOT** use fluid to clean out the well.
- The instrument should be handled with care. Avoid knocking, bumping, or dropping the instrument. Due to the size and portability of the 9102, it is vulnerable to being shocked and dropped as it is carried around. It may be easily dragged off from a counter top while in use. This action will not only cause damage to the instrument, but may damage probes that are inserted at the time. Never string probe cables or the power cord across an isle where people could trip over them and pull the instrument from its place. **DO NOT** place objects on top of the instrument or apply excessive pressure to the chassis. With a little care, this instrument will provide long-lasting, trouble-free operation.
- **DO NOT** slam the probe stems into the well. This type of action can cause a shock to the sensor.
- For dry-wells with removable probe sleeves, the sleeves can become covered with dust and carbon material. If the buildup becomes too thick, it could cause the sleeves to become jammed in the wells. Avoid this build up by periodically buffing the sleeves clean.
- If a sleeve should be dropped, examine the sleeve for deformities before inserting it in the well. If there is any chance of jamming the sleeve in the well, file or grind off the protuberance.
- If a hazardous material is spilt on or inside the equipment, the user is responsible for taking the appropriate decontamination steps as outlined by the national safety council with respect to the material.
- If the mains supply cord becomes damaged, replace it with a cord with the appropriate gauge wire for the current of the instrument. If there are any questions, call Hart Scientific Customer Service for more information.
- Before using any cleaning or decontamination method except those recommended by Hart, users should check with Hart Scientific Customer Service to be sure that the proposed method will not damage the equipment.
- If the instrument is used in a manner not in accordance with the equipment design, the operation of the dry-well may be impaired or safety hazards may arise.
- The 9102 calibrator is programmed and calibrated at the factory for optimum performance. Field adjustment to the program should not be necessary. If the unit is suspected to be out of calibration or in need of repair, please contact the factory for assistance. The unit should be recalibrated

at the factory yearly. Never attempt to modify the unit or alter the programmed constants.

- **Warning: Never introduce any fluids or other foreign material into the well block. This will damage the instrument and may cause sticking and damage to your probes. In the event that the instrument should require service or repair, please contact the manufacturer for assistance. The user should not attempt to make any repairs or adjustments.**

11 Troubleshooting

If problems arise while operating the 9102, this section provides some suggestions that may help you solve the problem. A wiring diagram is also included. Opening the unit without contacting Hart Scientific Customer Service may void the warranty.

11.1 Troubleshooting

Below are several situations that may arise followed by suggested actions for fixing the problem. Controller changes are indicated in the Controller Operation section of this manual. Refer to this section and , refer to Figure 3 and Figure 4 for the specific programming path. Refer to the Report of Calibration for any unique controller values.

Incorrect Temperature Reading

- Check the sensor span adjust "SPAn" in Level 2 to see that it is set correctly.
- Check the zero sensor error "2Er 0" in Level 2 to see that it is set correctly.
- Check input sensor "inPt" in Level 2 is set to "rtd". If not, master reset the controller.

The display is off after waiting 30 seconds

- Check that the power cord is plugged in.
- If the unit has power and the display is off, the fuse may be blown and the unit needs to be returned to Hart Scientific for repair. Contact Hart Scientific Customer Service.
- Check the 12 VDC connector
- If the connector is attached to a 12 V battery, check to see if the battery is dead. Replace the battery or recharge it, if necessary.
- If the RAPC 760 is connected to the unit but is not connected to the battery, the AC is overridden. Disconnect the RAPC 760 on the back of the unit.
- If the display is off and the unit is connected to the AC line only, contact Hart Scientific Customer Service.

The display flashes "Input Fail"

- There is a sensor error. Contact Hart Scientific Customer Service.

The display flashes "Input None"

- Contact Hart Scientific Customer Service.

Unit will not heat to 121°C

- The ambient temperature is too low.
- The fan does not turn off. Check the fan cut-out temperature setting in the controller. "LEVEl 1. SEt.2" should be set to 52.5°C.

Unit will not cool to –10°C

- The ambient temperature is too high

- The fan is not operating, contact Hart Scientific Customer Service.

User cannot set the temperature to the maximum or minimum values of the unit

- Check to see that "hi.SC" in Level 2 is set to 125
- Check to see that "Lo.SC" in Level 2 is set to –30

Controller lock-up

- Do a master reset of the controller in Level 3 by setting "rSEt" to "ALL". The controller transfers to Level 5 where the following parameters must be reentered.

InPt - rtd

Unit - °C

SPI.D - SSd

- Re-enter Level 1, 2, and 3, parameters. Refer to Figure 3, Figure 4, and the Report of Calibration for Level 1, Level 2, and Level 3 values.

11.2 Wiring Diagram

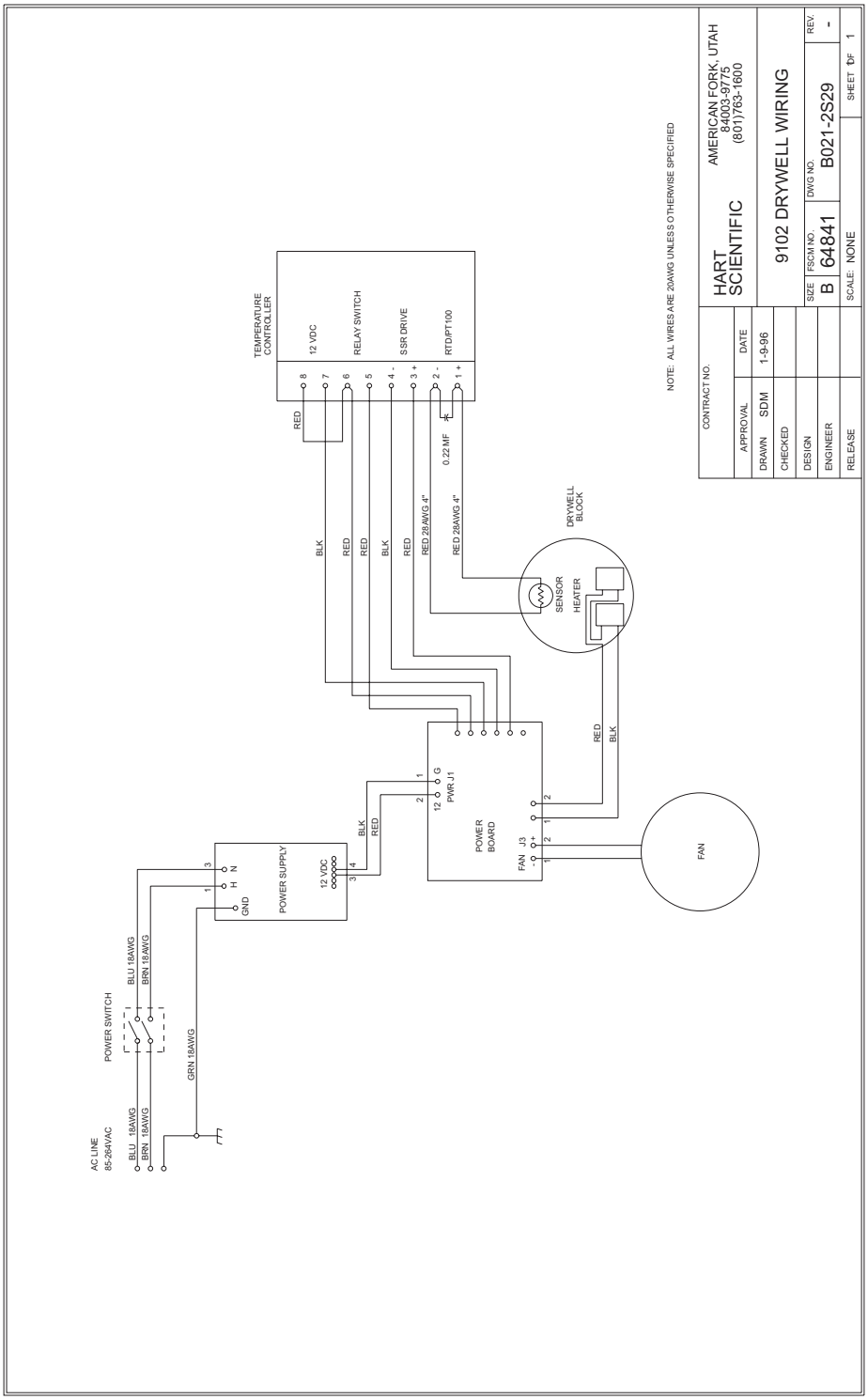

Figure 5 *Wiring Diagram*